



U.S. Department  
of Transportation

**Federal Aviation  
Administration**

# Memorandum

Subject: INFORMATION: New Policy with respect to compliance with § 25.785(d), Amendment 25-88, for certification of passenger seat armrests.

Date: November 25, 2002

From: Acting Manager, Transport Airplane Directorate, Aircraft Certification Service, ANM-100

Reply to  
Attn. of: 02-115-15

To: See Distribution

Regulatory  
Reference AC 25-17

The purpose of this memorandum is to provide additional Federal Aviation Administration (FAA) certification policy with respect to compliance with Title 14 Code of Federal Regulations (CFR) 25.785(d), Amendment 25-88, for transport category airplane passenger seat armrests. This policy is specifically aimed at documenting an alternative to current policy and guidance for demonstrating compliance with § 25.785(d) for seat armrests, which may be struck by persons seated behind them. The current version of § 25.785(d), as revised by Amendment 25-88, is very similar to the original version in part 25.

## **Current Regulation**

Section 25.785(d), Amendment 25-88:

“Each occupant of a seat that makes more than an 18-degree angle with the vertical plane containing the airplane centerline must be protected from head injury by a safety belt and an energy absorbing rest that will support the arms, shoulders, head, and spine, or by a safety belt and shoulder harness that will prevent the head from contacting any injurious object. Each occupant of any other seat must be protected from the head injury by a safety belt and, as appropriate to the type, location, and angle of facing of each seat, by one or more of the following:

“(1) A shoulder harness that will prevent the head from contacting any injurious object.

“(2) The elimination of any injurious object within striking radius of the head.

“(3) An energy absorbing rest that will support the arms, shoulders, head, and spine.”

Because this regulation is essentially the same from original to current version, the policy and guidance promulgated by this memorandum is applicable to all amendments to part 25 to date.

## Relative Existing Guidance and Past Practice

Because the requirements of § 25.785(d) have not significantly changed since the adoption of part 25, the policy that is provided for § 25.785(c)(2), Amendment 25-0, in Advisory Circular 25-17, “Transport Airplane Cabin Interiors Crashworthiness Handbook” dated July 15, 1991, is still in effect and may be utilized in demonstrating compliance with armrests in the head strike area. The guidance provided is found in paragraphs 81b(3) and 81b(5) of the AC.

In addition to the guidance in AC 25-17, the Transport Standards Staff of the Transport Airplane Directorate provided additional guidance to an applicant in a March 19, 1992, in a response to a request for written policy. The applicant was in the process of providing passenger seats for a new transport category airplane and requested clarification concerning the seat offset armrests as follows:

“...There are seat placements within each of the aircraft that are configured with varying degrees of offset, ranging from 0 to 1.64 inches. With respect to an FAA ruling that defines armrests that protrude into the head strike zone of the seat behind it as a head strike violation, where a head strike zone is defined as a 35-inch arc from the seat reference point (SRP) located between the center of the armrests, there is no established limit for seat offset.”

“This definition depicts a seat “offset” that is based on a seat positioned directly behind and in-line with the armcap. Since there can be varying degrees of offset, there is no definition for the boundary of acceptable or unacceptable offset. For instance, would a seat that is offset two (2) inches from being directly in line with a seat just forward be considered outside the armcap head strike zone?”

The FAA provided the following written response to the applicants’ request for guidance:

“Your first question concerned the amount of offset for seat armrests that is permissible without having to substantiate the armrest end cap for headstrike. When seats are located directly behind one another, the armrests are lined up longitudinally, and the headstrike zone is treated as a 35-inch arc measured over the width of the seat, between the armrests. When the seats are offset, such as might happen in the non-constant section of an airplane, a 35-inch arc measured in this manner would intersect an armrest of the forward seat. We consider that this situation has two aspects.”

“The first of these occurs where the forward seat is an aisle seat and has an exposed (bounded on one side only) armrest. In this case, we consider that an offset that positions the forward armrest within the projected headstrike path of the rear occupant as described above is not acceptable unless the armrest is substantiated for headstrike. Depending upon the certification basis of the airplane this substantiation may take different forms. For airplanes with a certification basis prior to Amendment 25-64 to part 25, the substantiation may be a test, or an analytical comparison to the other components in the headstrike path, showing that the armrests is no worse. For airplanes with Amendment

25-64 in the certification basis, a Head Injury Criterion measurement of 1000 or less must be shown.”

“The second aspect occurs when the offset is not exposed. In this case, due to the protection afforded by the surrounding seatbacks, we consider that an offset of two (2) inches is acceptable without further substantiation of the armrest. Offsets greater than two (2) inches would have to be substantiated as described above.”

The Seattle Aircraft Certification Office sent a letter to an applicant on July 31, 1992, that modified the guidance provided above as follows:

“The subject provision, at all Amendment levels to date, requires the elimination of any injurious object within striking radius of the head. Past guidance on the subject is compiled in the reference AC. This letter supplements that AC guidance by correcting an error which was carried over from past guidance, and expands on existing guidance.”

“The width of the headstrike zone had been previously defined by the extended centerlines of each armrest. Observance of this definition would have likely required the armrest of every seat group on every airplane to be padded, including those seats directly in line in fuselage constant sections. It has been determined that this was not an intended consequence of this definition, and that the width of the headstrike zone should be redefined by the extended inner surfaces of the armrests.”

As noted above there are existing means to demonstrate compliance with § 25.785(d) and these means will remain as acceptable approaches to certification of the armrests. The policy is as follows:

### **Definitions Relative to New Policy**

Armrests that might possibly be struck by persons seated behind (aft of) them are characterized as “bounded” or “unbounded.” Bounded armrests are defined as follows:

1. An armrest that has a seatback on both sides, with the distance between the structure of the adjacent seatbacks no greater than five (5) inches, or
2. An armrest that has a seatback on one side and the airplane sidewall panel or a wall that is part of an airplane furnishing (e.g., galley, closet, lavatory) on the other side with the distance between the structure of the seatback and the panel/wall no greater than five (5) inches.

For purposes of this memorandum, the structure of the seatback is considered to be the parts of the seatback with load carrying capability. It does not include upholstery material or soft foam installed for occupant comfort. In some seat designs there is a metal frame in the seatback that forms the support structure to which the foam and upholstery are used to provide the shape of the seatback. When measuring the distance between the structure of the

adjacent seatbacks of no greater than five (5) inches, the measurement would be between these metal or composite supports structures.

Unbounded armrests are those that do not meet either definition above. Additionally, seat places that are located aft of unbounded armrests may be characterized as either “exposed” or “non-exposed.” The non-exposed seat place is typically an aisle seat place, i.e., located adjacent to a passenger aisle (see Figure 1). The exposed seat place is typically located where the number of seats in the row forward is different from that of the seat row aft. For example, near Type III overwing exits, many airplanes have a double seat installed inboard of the exit with an empty space between the seat and the exit. The seat row aft of the double seat has a triple seat (see Figure 2). In Figure 2, seat place “A” is an exposed seat place that makes the outboard armrest of the double seat an unbounded exposed armrest.

The definitions above apply to all armrests in the airplane as applicable. The existing policy contained in AC 25-17 paragraphs 81b(3) and 81b(5) are still applicable to the armrests identified in the new policy below.

### **New Policy**

Note: The policy below addresses armrests within the 35 inch head strike arc and surfaces 18 inches and greater above the floor. Armrests outside the 35-inch head strike arc and armrest surfaces less than 18 above the floor are acceptable as defined in AC 25-17 paragraphs 81b(3) and 81b(5).

1. An armrest is acceptable by inspection if the armrests of two consecutive (i.e., one aft of the other) seat assemblies (seats need not be of the same part number ) are offset no greater one half (0.5) inch total, including design and production tolerances.
2. Bounded armrests and non-exposed unbounded armrests are acceptable if:
  - a. the armrests of two consecutive seat assemblies are offset greater than one half (0.5) inch but no greater than two (2) inches total, including design, and production tolerances, and
  - b. the breakover feature of the seatback(s) adjacent to the armrest in the forward seat assembly is (are) locked out.

The seatback breakover feature may be locked out by any method that requires a tool to release the lock out provision. The lockout of the breakover feature must be effective for the seatback in the upright position used for taxi, takeoff and landing. Seatbacks incorporating an energy absorbing feature to meet the HIC requirements of § 25.562 are considered to have the breakover lockout and are acceptable. Whatever the method of seatback breakover lock out, there typically is some movement of the seatback. This movement of the seatback is acceptable as long as when the seatback is moved to the worst case position by a small hand load applied to the top of the seatback, the armrest is

still afforded protection by the seatback, with the end of the top of the armrest being forward of the aft side of the seatback.

3. Bounded armrests and non-exposed unbounded armrests, where the offset is greater than two (2) inches total, including design and production tolerances, need to be addressed as being injurious objects within the striking radius of the head, e.g., by padding the armrest.
4. Exposed unbounded armrests; if the armrests of two consecutive seat assemblies that are offset by more than one half (0.5) inch total, including design and production tolerances, need to be addressed as being injurious objects within the striking radius of the head, e.g., by padding the armrest.
5. Armrests that are padded (using appropriate padding material as described in paragraph 81b(3) of AC 25-17) must have the padding cover the length of the armrest that is encompassed by 35-inch and smaller head strike arcs. Bounded armrest, where the seatback(s) have the breakover feature locked out, need not be padded to encompass the entire 35 inch head strike arc because the seatbacks prevent the contact of the armrest on the forward side of the seatback(s). Therefore, these armrests need only be padded to the forward edge of the seatback(s) in their upright position achieved after the small hand force is applied to the seatback. Portions of the armrest surface that cannot be contacted by the head are not required to be padded, e.g., the lower (or under) surface of a curved armrest.
6. As an alternative to the use of padding, surfaces within the striking radius of the head that translate out of the striking radius under a nominal (10 pound) load may be considered to provide adequate protection, e.g., armrests that have been pivoted upward, which pivot downward out of the head strike arc under the nominal load. During an evaluation of this feature, the load must be applied in a direction that approximates the motion of a seated and belted occupant in the seat aft of the armrest under crash conditions.

Figure 1

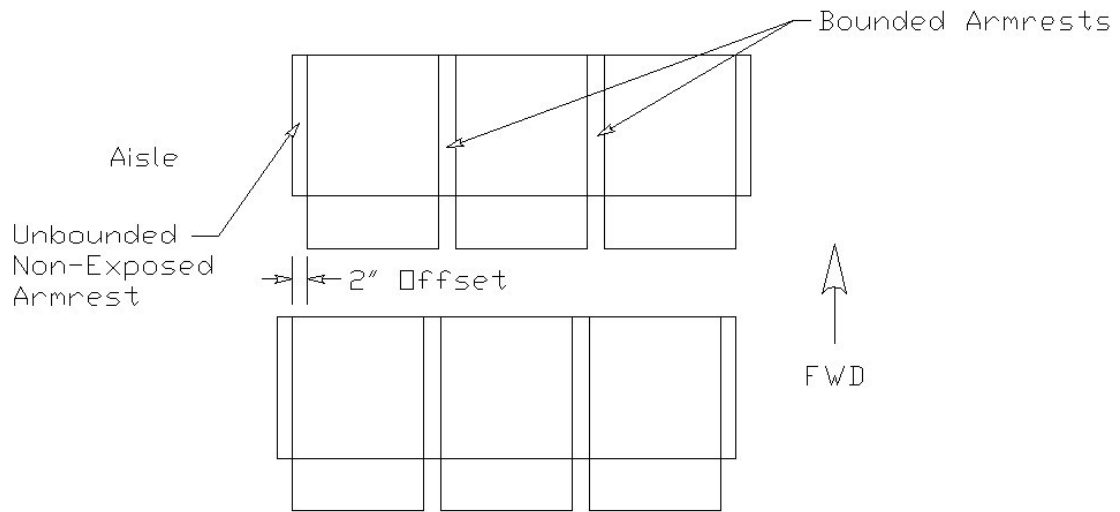
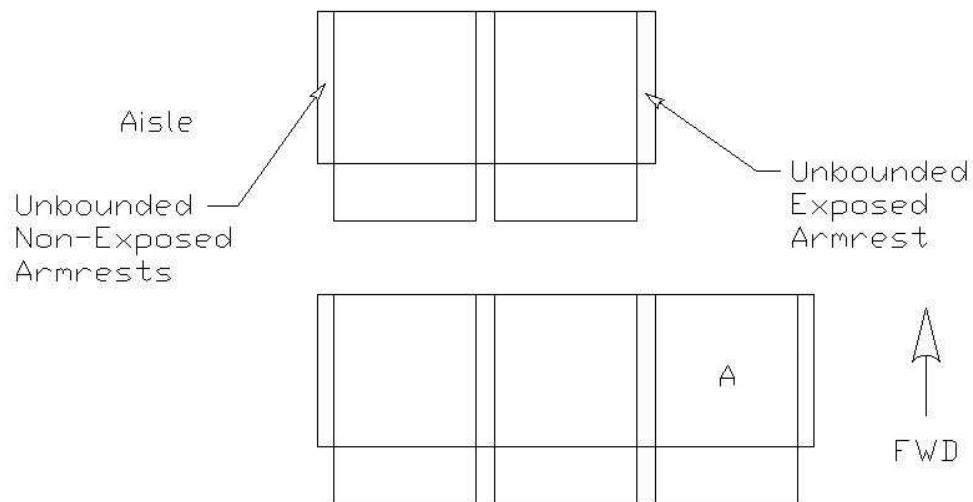


Figure 2



### Effect of Policy

The general policy stated in this document does not constitute a new regulation or create what the courts refer to as a “binding norm.” The office that implements policy should follow this policy when applicable to the specific project. Whenever an applicant’s proposed method of compliance is outside this established policy, it must be coordinated with the policy issuing office, e.g., through the issue paper process or equivalent.

Applicants should expect that the certificating officials will consider this information when making findings of compliance relevant to new certificate actions. Also, as with all advisory material, this policy identifies one means, but not the only means, of compliance.

Any questions related to this policy may be directed to Jayson Claar at (425) 227-2194.

/s/

Ali Bahrami

	<b>DISPOSITION OF PUBLIC COMMENTS ON DRAFT POLICY STATEMENT 02-115-15, COMPLIANCE WITH 25.785(D), AMENDMENT 25-88, CERTIFICATION OF PASSENGER SEAT ARMRESTS</b>	
Commenter	Comment	Disposition
GAMA	GAMA is concerned that all armrests meeting the definition of unbounded armrests would be required to be padded under the new policy.	The definitions do apply to all seats, however, only those armrests within the 35-inch head strike arcs need to be padded. A clarification to the policy will be made to address this issue.
GAMA	GAMA is concerned that the policy item numbers 1 and 2 are contradictory concerning the amount of acceptable offset.	The policy item number 1 is intended to address armrest offset 0 to .5 inches and item number 2 is intended to address bounded armrest and non-exposed unbounded armrest offset between .5 and 2.0 inches. A clarification to the policy will be made to address this issue.
GAMA	GAMA proposes that for bounded armrest offset more than 2.0 inches, the padding need not extend to the full 35 inches when the seatbacks provide protection for the armrest forward of the aft side of the seatback.	The FAA agrees with the comment provided that the seatbacks do provide the protection. To provide the protection the seatback breakover feature must be locked out. A clarification to the policy will be made to address this issue.
GAMA	GAMA is concerned that the policy item number 6 is unclear on the intent and application of this policy for armrests that translate out of the headstrike arc with a nominal 10 pound load.	Many of the armrests pivot upward such that the armrest could protrude beyond the seatbacks. The intent of this policy is to accept these armrests that translate out of the striking radius under a nominal (10 pound) load. A clarification to the policy will be made to address this issue.

GAMA	GAMA proposes that the option of passing a HIC test is included in policy item number 6.	The FAA agrees that another acceptable method of demonstrating compliance is a successful HIC test on an object. However, that approach is already documented as an acceptable means of compliance in this policy memo. No change to the policy memo is required.
Boeing	Boeing is concerned that the policy does not define what “the structure” of the seatback is and requests clarification.	The FAA agrees that the policy does not define what “the structure” of the seatback is and does need to provide clarification. A clarification to the policy will be made to address this issue.
Boeing	Boeing requested a revision to clarify the five (5) inch measurement applies only within the 35 inch headstrike arc.	The FAA partially agrees with the Boeing request. A clarification to the effectivity of the policy will be included.
Boeing	Boeing is concerned that the policy item number 2 is not clear and proposed revised and additional wording for clarification for the issue of locked out seatbacks.	The FAA partially agrees with the Boeing request for the changes to this item. A revision to the policy will be made to address this issue.
Boeing	Boeing is concerned that policy item number 5 is not clear and proposed revised and additional wording for clarification. The Boeing concern is what armrest parts need to be padded and how much of the armrest needs padding.	The FAA partially agrees with the Boeing request for the changes to this item. A revision to the policy will be made to address this issue.
Boeing	Boeing requested the policy item number 6 be revised to state loads above 10 pounds be acceptable on a case-by-case basis.	The FAA agrees with the Boeing position in general that deviations to this policy can be made on a case-by-case basis but we disagree that it needs to be documented in the policy. No change to the policy will be made.